СЕКЦИЯ 3

ТЕПЛОСТОЙКОСТЬ, ГОРЮЧЕСТЬ И ПОЖАРОБЕЗОПАСНОСТЬ ПЛАСТМАСС И ПОЛИМЕРНЫХ МАТЕРИАЛОВ

COMBUSTIBILITY OF POLYMERIC MATERIAL AND FIRE SAFETY OF THE BUILDINGS

Karol Potoček , *Doc., Ing., CSc.* , Tomáš Potoček, *Ing., PhD, University of Žilina, Faculty of Civil Engineering*
Slovakia, Komenského 52, 010 26 Žilina, Slovakia
E-mail: potocek@fstav.uniza.sk

1. Introduction

Present time brings in increased ratio possibility to use polymeric materials in various building applications with different character. It can be building construction or its parts, inside building facilities, production processes and etc. This mass usage of polymeric material brings also higher risks of fires because these materials have higher combustibility and heat value.

Fire experiences analyses shows that it is possible to prevent the fires also in these conditions or get fire under control so that we can save more human lives and prevent property damage. One way how to achieve higher structural fire protection is its division into smaller each other divided parts – fire cells.

2. Building division on fire cells

Fire cells are building parts. Fire division walls and ceilings limit them. Their basic function is to protect fire spread from one fire cell to near fire cell. The fire can spread in fire cell all over fire cell regardless of fire cell spaces and its particular parts. Fire cell is then considered as basic unit for determination of fire or economic risk.

From this reason it is important to suggest building constructions, which close fire cell so that without static and aesthetical requirements they are up to fire standards. Basic building division on fire cells can be performed in the time of building project preparation. In the case of existing building, in every change of its usage. The building consists of more fire cells if:

- the building has the spaces, which must create according to fire regulations fire cells,
- if the building with its size exceeds maximal sizes determined by fire regulations for fire cell size.

The buildings which size doesn't exceed maximal fire cell size are considered as one fire cell. The question is the determination of the size – of fire cell surface. So that fire risk and economic effectiveness will be taken into account.

3. Fire cell size

Characteristic fire cell parameter is its section plan surface in the building. Its size is expressed in A (m^2). Currently methods used for determination of fire cell size go on the character of building usage.

The building or its part has these two determinations: non-production buildings, production buildings.

The highest allowed fire cell sizes in non-production buildings are determined in keeping with:

- calculation fire load p_v [$kg.m^{-2}$],
- coefficient of combustible materials a [-],
- number of aboveground (n_{pn}) and underground (n_{pp}) building floors,
- mutual static connection among fire cells,
- combustibility of building constructions which limit fire cell,

The highest allowed section plan surfaces of fire cell fire floor can be for:

a) aboveground fire floors from incombustible constructions

$$A_{max} = \frac{1250 - 2020.\ln a}{0{,}2.(n_{pn})^{1/2}} \quad [m^2] \qquad (1)$$

b) underground fire floors from incombustible constructions

$$A_{max} = \frac{1250 - 2020.\ln a}{0{,}2.(20 + n_{pp})^{1/2}} \quad [m^2] \qquad (2)$$

c) aboveground fire floors from mixed constructions

$$A_{max} = \frac{1250 - 2020.\ln a}{0{,}35.(n_{pn})^{1/2}} \quad [m^2] \qquad (3)$$

d) underground fire floors from mixed constructions

$$A_{max} = \frac{1250 - 2020.\ln a}{0{,}35.(25 + n_{pp})^{1/2}} \quad [m^2] \qquad (4)$$

e) aboveground fire floors from combustible constructions

$$A_{max} = \frac{1250 - 2020.\ln a}{0{,}45.(n_{pn})^{1/2}} \quad [m^2] \qquad (5)$$

It is possible to consider for practical usage in first approximation: $0{,}3 \le a \le 1{,}3$; $1 \le n_{pn} \le 12$; $1 \le n_{pp} \le 3$.

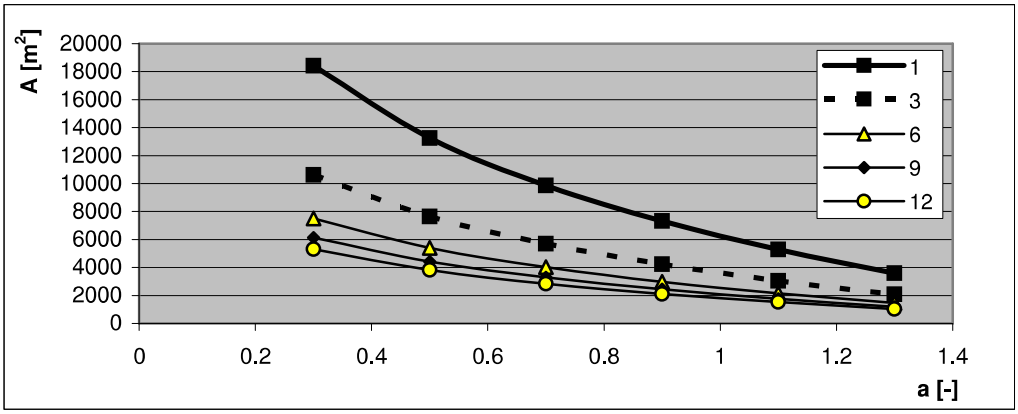

Fig.1 – Incombustible constructions – aboveground floors

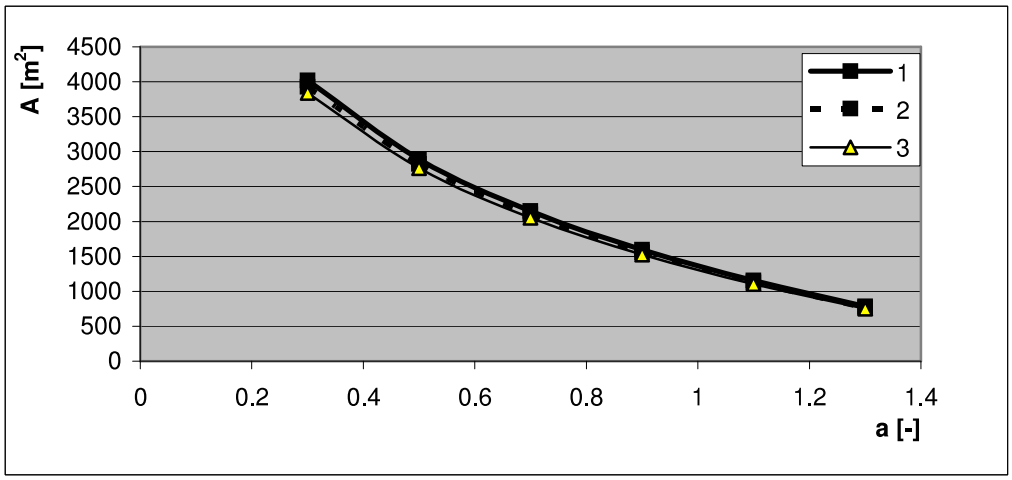

Fig.2 – Incombustible constructions – underground floors

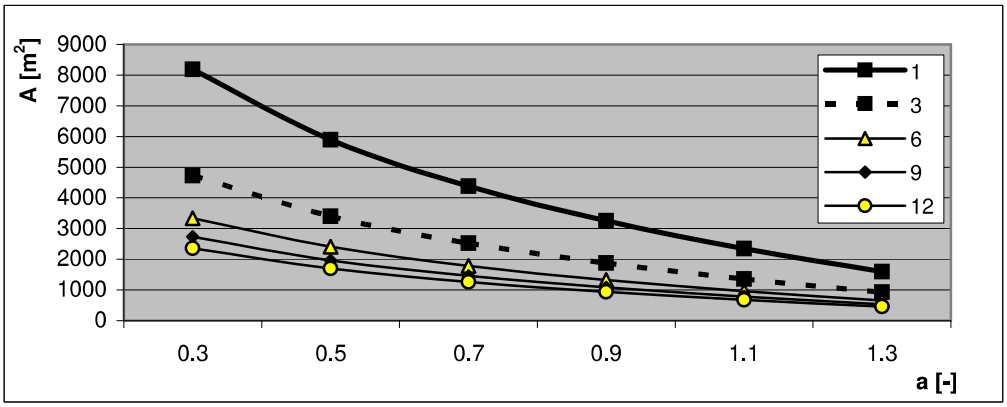

Fig.3 – Combustible constructions – above ground floors

The size of fire cell section plan at chosen margin conditions is graphically illustrated on Fig.1, 2 and 3. Lets see so determined section plan surface from the side of economic risk index. Economic risk index is the function:

$$i_e = f(E_s, U, Z_s) \qquad [-] \qquad (6)$$

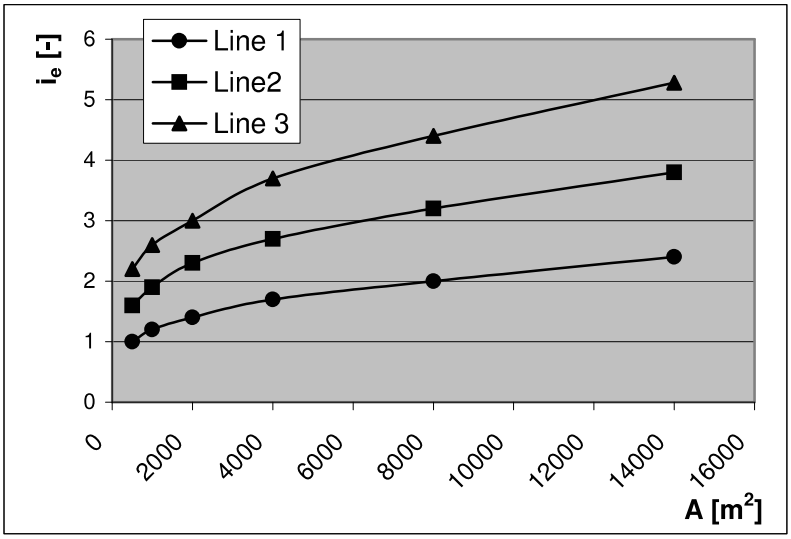

Fig.4 – Values i_e for various sizes of fire cell surfaces

In this formula – E_s is the damage coefficient, U is surface coefficient and Z_s is the coefficient of combustion products. We consider following values of coefficients for non-production buildings $1,0 \leq E_s \leq 2,2$; $1,0 \leq U \leq 2,2$; $Z_s = 1,0$. Fire cell section plan size in keeping with economic risk index is graphically illustrated on Fig.4.

4. Conclusion

The limits or prevention of fire spread from fire cell into other building spaces are important steps in structural fire protection strategy. The basic requirement is total compatibility and stability of main bearing building construction.

It is necessary to take various requirements (which can be contrary) into account at planning of fire cells:

- with higher fire cell surface there are higher extents of damages i_e [-], these damages will be smaller with smaller chosen surface A [m^2],
- with fire cell minimization there are higher costs for building division on fire cells and there can be also operation difficulties.

From noticed reasons, it is necessary to go on optimal surface at determination of fire cell size. This optimal surface is determined by point of intersection of interests supposed damages and investment costs including operation for formation of fire cell in the building.

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